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Zhibo Zhao

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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* ZHIBO ZHAO, BRYAN A. GILLESPIE,  
TAEYOUNG HAN, JOHN R. SMITH and  
BRIAN K. FULLER

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Appeal 2008-004653  
Application 10/646,551  
Technology Center 3700

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Decided: December 1, 2009

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Before JENNIFER D. BAHR, LINDA E. HORNER, and  
JOHN C. KERINS, *Administrative Patent Judges*.

KERINS, *Administrative Patent Judge*.

DECISION ON APPEAL

## STATEMENT OF THE CASE

Zhibo Zhao et al. (Appellants) seek our review under 35 U.S.C. § 134 of the Examiner's final rejection of claims 1-16. Claims 17-20 stand withdrawn. We have jurisdiction under 35 U.S.C. § 6(b) (2002).

## SUMMARY OF DECISION

We REVERSE.

## THE INVENTION

Appellants' invention is directed to a gas collimator and a kinetic spray nozzle incorporating a gas collimator. (Appeal Br., Claims Appendix, Claims 1, 5). Independent claim 1 is reproduced below, and is representative of the overall claimed subject matter:

1. A gas collimator for a kinetic spray nozzle comprising:

a collimator having a central hole surrounded by a plurality of gas flow holes and a length of from 10 to 30 millimeters; said gas flow holes having a hydraulic diameter of from 0.5 to 5.0 millimeters.

## THE REJECTIONS

The Examiner relies upon the following as evidence of unpatentability:

|                |                 |               |
|----------------|-----------------|---------------|
| Roberts        | US 3,645,298    | Feb. 29, 1972 |
| Mochida        | US 4,740,408    | Apr. 26, 1988 |
| Belashchenko   | US 5,932,293    | Aug. 3, 1999  |
| Van Steenkiste | US 6,139,913    | Oct. 31, 2000 |
| Popoola        | US 6,464,933 B1 | Oct. 15, 2002 |

The Examiner has rejected<sup>1</sup>:

(i) claims 1-3 and 5-10 under 35 U.S.C. § 103(a) as being unpatentable over Van Steenkiste in view of Roberts;

(ii) claims 1-3 and 5-10 under 35 U.S.C. § 103(a) as being unpatentable over Popoola in view of Roberts;

(iii) claim 4 under 35 U.S.C. § 103(a) as being unpatentable over Van Steenkiste or Popoola in view of Roberts, and further in view of Mochida; and

(iv) claims 11-16 under 35 U.S.C. § 103(a) as being unpatentable over Van Steenkiste or Popoola in view of Roberts, and further in view of Belashchenko.

#### ISSUE

The Examiner concluded that it would have been obvious to modify the gas collimator of either Van Steenkiste or Popoola to have the claimed collimator length and claimed gas flow hole diameters, in view of the teachings of Roberts. Appellants contend that the combination of the teachings is improper and that the combination, if made, does not disclose or suggest the claimed range of diameters for the gas flow holes. The issue presented on appeal is whether Appellants have demonstrated that the Examiner erred in reaching the conclusion that the claims are unpatentable over Van Steenkiste or Popoola in view of Roberts.

#### FINDINGS OF FACT

The following enumerated findings of fact (FF) are supported by at least a preponderance of the evidence. *Ethicon, Inc. v. Quigg*, 849 F.2d

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<sup>1</sup> A § 103(a) rejection of claims 1-3 and 5-10 over Van Steenkiste or Popoola alone was expressly withdrawn by the Examiner. (Answer 2).

1422, 1427 (Fed. Cir. 1988) (explaining the general evidentiary standard for proceedings before the Office).

FF 1. The Van Steenkiste patent refers to the gas collimator disclosed therein as a “flow straightener”. (Van Steenkiste, col. 3, ll. 37-39). Van Steenkiste discloses nothing about any aspect of the design of the flow straightener in terms of any effect on the function of the kinetic spray apparatus in which it is used. (Van Steenkiste, *passim*).

FF 2. Van Steenkiste is silent with respect to any dimensional characteristics and the possible effect of selecting or changing any of the dimensions of the flow straightener. (Van Steenkiste, *passim*).

FF 3. The Roberts patent does not disclose specific lengths or ranges of lengths for its gas collimator. (Roberts, *passim*).

FF 4. Roberts discusses the dimensions of its gas collimator in terms of selecting a length to obtain a particular aspect ratio (no specific aspect ratios or ranges thereof being disclosed) of length to cross-section to thus achieve a particular pressure drop. (Roberts, col. 4, ll. 65-68).

FF 5. Roberts consistently discloses the size of the gas flow holes in its collimator as having a maximum cross-section dimension of under approximately 500 microns. (See, e.g., Roberts, col. 3, ll. 44-47).

FF 6. Popoola discloses a kinetic spray apparatus having a diaphragm 26 through which the heated gas passes prior to entering the throat of the nozzle. (Popoola, Fig. 2).

FF 7. Popoola discloses nothing about any aspect of the design of the diaphragm in terms of the effect on the function of the kinetic spray apparatus in which it is used. (Popoola, *passim*).

FF 8. Popoola is silent with respect to any dimensional characteristics and the possible effect of selecting or changing any of the dimensions of the diaphragm. (Popoola, *passim*).

#### PRINCIPLES OF LAW

A claim is unpatentable under 35 U.S.C. § 103(a) if “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). *See also KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 407 (2007) (“While the sequence of these questions might be reordered in any particular case, the [*Graham*] factors continue to define the inquiry that controls.”)

The Examiner’s articulated reasoning in the rejection must possess a rational underpinning to support the legal conclusion of obviousness. *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). The analysis need not seek out precise teachings directed to the specific subject matter of the claim but can take into account the inferences and the creative steps that a person of ordinary skill in the art would employ. *KSR Int’l*, 550 U.S. at 418.

## ANALYSIS

### *Claims 1-3 and 5-10--Obviousness--Van Steenkiste in view of Roberts*

Independent Claim 1 is directed to a gas collimator having a central hole surrounded by a plurality of gas flow holes, the collimator having a length of from 10 to 30 millimeters, and the gas flow holes having a hydraulic diameter of from 0.5 to 5.0 millimeters. Independent Claim 5 is directed to a kinetic spray nozzle having a gas collimator with the same dimensional ranges for the length of the collimator and the diameter of the gas flow holes. (Appeal Br., Claims Appendix, Claims 1, 5).

According to Appellants' Specification, as evidenced in test results of kinetic spray nozzles having a collimator as claimed and having the prior art collimator, the use of a collimator having a length in the claimed range and having gas flow holes of the claimed size, resulted in increased efficiency of the kinetic spray process, in both low pressure and high pressure particle feed systems, over prior art collimators. (Spec., p. 10, para. [0034]-p. 12, para. [0038]; Figs. 7, 9A, 9B). The prior art collimators were, according to Appellants, of a length of only about one millimeter. (Spec., p. 7, para. [0025]).

The Examiner found that the Van Steenkiste patent failed to disclose the length of the collimator disclosed therein, as well as the diameter of the gas holes. (Answer 3). The Examiner further found that the Roberts patent discloses a collimator having flow holes with a hydraulic diameter of 0.5 millimeters and a selectable length. (Answer 3-4). The Examiner concluded that it would have been obvious in view of Roberts to provide the device of Van Steenkiste with a collimator having a length in the claimed range and gas hole diameters in the claimed range. The Examiner stated that, "[d]oing

so would provide a way to control flow.” (Answer 4). The Examiner further supports the conclusion by noting that the discovery of an optimum or working range involves only routine skill in the art. Further, the Examiner notes that Roberts discloses that the length of the collimator can be selected to obtain a desired aspect ratio between the length and the cross-sectional diameter of the openings therethrough, to yield a device with a particular pressure drop, and that it is well known in the art that a lower flow pressure results in a more uniform flow, and that the proposed combination leads to the ability to maintain a more uniform flow with less turbulence. (Answer 5-6).

Appellants contend that the Examiner has failed to establish a prima facie case of obviousness, asserting that there is no teaching, suggestion or motivation (TSM) to combine the references<sup>2</sup>; that the Examiner has not established that there would be a reasonable expectation of success were the references considered for combination; and that the combination of references do not teach or suggest all claim limitations. Despite the framing of the first assertion in terms of TSM, which, under *KSR*, is no longer to be rigidly applied, Appellants do challenge the reasoning set forth by the Examiner as the basis for combining the teachings of the two references.

Appellants argue that the Van Steenkiste patent does not disclose or teach anything that would lead a person of ordinary skill in the art to consider modifying the length of the gas collimator 40 disclosed therein. (Appeal Br. 7). The Van Steenkiste patent refers to this gas collimator as a “flow straightener”, and aside from being able to infer from its name that it

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<sup>2</sup> The Appeal Brief and Reply Brief were both filed prior to April 30, 2007, the date of the Supreme Court decision in *KSR*.



is provided to straighten the gas flow stream as it moves toward the throat of the nozzle, nothing is disclosed regarding any aspect of its design as affecting the function of the kinetic spray apparatus in which it is used. (FF 1). Van Steenkiste is silent with respect to any dimensional characteristics and the possible effect of selecting or changing any of the dimensions of the flow straightener. (FF 2).

Appellants further contend that, in view of the lack of detail in Van Steenkiste in describing the flow straightener, there is nothing in Van Steenkiste disclosing or suggesting that modifying the flow straightener in any way, let alone its length, would be a result effective variable pertaining to the deposition efficiency of the kinetic spray system. (Appeal Br. 7-8). We agree. As such, the Examiner's conclusory statement that the discovery of an optimum or working range for the length of the collimator involves only routine skill in the art is misplaced, in that the Van Steenkiste patent fails to even point the person of ordinary skill in that direction.

The Roberts patent does not disclose specific lengths or ranges of lengths for its gas collimator. (FF 3). Rather, Roberts discusses the dimensions in terms of selecting a length to obtain a particular aspect ratio (no aspect ratios or ranges thereof being disclosed) of length to cross-section to achieve a particular pressure drop. (FF 4). The Examiner observes, as noted above, that lower pressures lead to more uniform, less turbulent flow, but fails to address how that general knowledge would specifically apply to a kinetic spray process, and what effect a lower gas pressure would have in a kinetic spray process in which the gas is required to entrain small metallic particles. The reasoning also fails to address where the person of ordinary

skill in the art would glean from the prior art that some particular level of turbulent gas flow is problematic in the operation of kinetic spray systems.

Appellants have demonstrated that the Examiner has not adequately set forth articulated reasoning supported by rational underpinnings as to why the person of ordinary skill in the art would find it obvious to combine the teachings of Van Steenkiste and Roberts to reach the claimed invention.

Appellants additionally argue that the combination of Van Steenkiste and Roberts does not result in a disclosure or suggestion of providing gas flow holes having a diameter of from 0.5 to 5.0 millimeters. Roberts consistently discloses the size of the gas flow holes in that collimator as having a maximum cross-section dimension of under approximately 500 microns. (FF 5). Appellants note that 500 microns and the claimed lower limit of 0.5 millimeters are the same dimension, and that the disclosure that the Roberts gas flow holes are to be *under* approximately the claimed lower value means that Roberts does not disclose a value within the claimed range. (Appeal Br. 9-10).

The record is not clear as to how the Examiner has interpreted the disclosure of a cross-section of under approximately 500 microns as meeting the claim limitation (possibly by considering “approximately” as allowing for larger sizes), but the specific examples provided in Roberts (under 25 microns) evidence that Roberts does not contemplate the use of gas flow holes within the claimed range. As such, Appellants have demonstrated that the Examiner erred in concluding that the combined teachings of Van Steenkiste and Roberts render obvious a gas collimator having gas flow holes of a diameter of from 0.5 to 5.0 millimeters.

The rejection of claims 1-3 and 5-10 as being unpatentable over Van Steenkiste in view of Roberts will not be sustained.

*Claims 1-3 and 5-10--Obviousness--Popoola in view of Roberts*

The rejection over Popoola in view of Roberts presents essentially the same issues as are addressed above. Indeed, the Examiner groups the two grounds of rejection in presenting the detailed reasoning for the rejections, and Appellants, for the most part, treat Van Steenkiste and Popoola as having the same disclosure as they pertain to the claims and the grounds of rejection.

Popoola discloses a kinetic spray apparatus having a diaphragm 26 through which the heated gas passes prior to entering the throat of the nozzle. (FF 6). The entirety of the disclosure of this component reads, “[i]t may be desirable to employ a diaphragm 26, having ports 27, in the ante-chamber of nozzle 13 for equalizing the gas velocity there-into.” (Popoola, col. 3, ll. 2-4).

Like the Van Steenkiste patent above, Popoola discloses nothing about any aspect of the design of the diaphragm as affecting the function of the kinetic spray apparatus in which it is used. (FF 7). Popoola is also silent with respect to any dimensional characteristics and the possible effect of selecting or changing any of the dimensions of the diaphragm. (FF 8).

Appellants similarly contend that there is nothing in Popoola disclosing or suggesting that modifying the diaphragm in any way, let alone its length, would be a result effective variable relative to the deposition efficiency of the kinetic spray system. We again find ourselves in agreement. Moreover, the disclosure that, “it may be desirable” to provide the diaphragm suggests that, while it might have some effect on the overall

operation of the device, the inclusion of a diaphragm is not looked at as being essential or critical to the operation. As such, it is difficult to imagine that persons of ordinary skill in the art would consider that modifications to that structure should be explored in seeking to improve the operation of the system.

For essentially the same reasons as discussed in the preceding section, Appellants have demonstrated that the Examiner has not adequately set forth articulated reasoning supported by rational underpinnings as to why a person of ordinary skill in the art would find it obvious to combine the teachings of Popoola and Roberts to reach the claimed invention. Appellants have also demonstrated that the Examiner erred in concluding that the combined teachings of Popoola and Roberts render obvious a gas collimator having gas flow holes of a diameter of from 0.5 to 5.0 millimeters.

The rejection of claims 1-3 and 5-10 as being unpatentable over Popoola in view of Roberts will not be sustained.

*Claim 4--Obviousness--Van Steenkiste/Popoola in view of Roberts and Mochida*

The Examiner does not rely on the Mochida patent to remedy the deficiencies noted with respect to the Van Steenkiste, Popoola and Roberts references, and it does not appear that the Mochida patent addresses, in any way, those deficiencies. The rejection of claim 4 will not be sustained.

*Claims 11-16--Obviousness--Van Steenkiste/Popoola in view of Roberts and Belashchenko*

The Examiner does not rely on the Belashchenko patent to remedy the deficiencies noted with respect to the Van Steenkiste, Popoola and Roberts references, and it does not appear that the Belashchenko patent addresses, in

any way, those deficiencies. The rejection of claims 11-16 will not be sustained.

### CONCLUSIONS

Appellants have established that the Examiner erred in rejecting claims 1-3 and 5-10 under 35 U.S.C. § 103(a) as being unpatentable over either Van Steenkiste or Popoola in view of Roberts; erred in rejecting claim 4 under 35 U.S.C. § 103(a) as being unpatentable over those references and further in view of Mochida; and erred in rejecting claims 11-16 under 35 U.S.C. § 103(a) as being unpatentable over Van Steenkiste or Popoola in view of Roberts and Belashchenko.

### DECISION

The decision of the Examiner to reject claims 1-16 is reversed.

### REVERSED

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